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Docket No. AT9-98-464

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Sir:

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**For: METHOD AND APPARATUS FOR A META DATA SERVICE IN A DATA PROCESSING SYSTEM**

Enclosed are also:

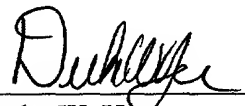
- ☒ 17 Pages of Specification
- ☒ 2 Pages of Claims
- ☒ 10 Sheet(s) of Drawings
- ☒ An Abstract
- ☒ A Declaration and Power of Attorney
- ☒ Form PTO 1595 and assignment of the invention to IBM Corporation


## CLAIMS AS FILED

FOR	Number Filed	Number Extra	Rate	Basic Fee (\$760)
Total Claims	12	-20 = 0	X \$ 18	= \$0
Independent Claims	2	-3 = 0	X \$ 78	= \$0
Multiple Dependent Claims	0		X \$260	= \$0
<b>Total Filing Fee</b>				<b>= \$760</b>

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## **METHOD AND APPARATUS FOR A META DATA SERVICE IN A DATA PROCESSING SYSTEM**

5

### **BACKGROUND OF THE INVENTION**

#### **1. Technical Field:**

The present invention relates to a method and apparatus for sharing data between resources. Specifically, the method involves providing meta data definitions  
10 for data processing of data objects.

#### **2. Description of Related Art:**

Many applications utilize data that has been formatted a particular way. When  
15 another application requires the same data, a second application may attempt to retrieve that data from a first application. Unfortunately, the second application may require the data in a different format than that used by the first application. For example, one organization might identify the submitter of a help desk incident by the submitter's customer number while another organization might use the submitter's  
20 physical location or local area network (LAN) address. The different data formats expected by the different applications present a obstacle to the efficient sharing of data between applications.

Traditionally, making a change to an application to accommodate this type of difference would involve changing the source code or data structures which describe  
25 the object (and possibly other code) and then regenerating the application. The traditional update method implies the availability of the source code and creates a need to maintain the changed source code. Therefore, it would be advantageous to have an improved method and apparatus to share data between different applications.

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## SUMMARY OF THE INVENTION

As a solution to the problem of distributed knowledge of data object definitions, data object definitions are removed from the source code. A Meta Data  
5 Service is created and made available on a network which knows the definitions of all of the objects that are used by applications that are designed to use the Meta Data Service. When an object is created, the Meta Data Service creates and stores a meta definition for the object.

Using this solution, data objects are passed over a network in a "soft" format.  
10 Applications within a distributed data processing system are designed in such a manner such that, at any stage of object processing, an application does not assume to understand the definition or structure of an object, nor is an application hard-coded with the object definitions. At each stage, an application queries the Meta Data Service for the meta definition of the object before proceeding with the processing of  
15 an object. The application then receives a meta definition for the data object that allows the application to perform properly tailored processing for the data object.

One of ordinary skill in the art will understand that the advantage of the Meta Data Service could not be accomplished using the subclassing feature of an object-oriented language. In other words, adding an attribute to an object's meta definition  
20 is not equivalent to subclassing an object. When an object is extended by subclassing, the object adopts a new object type. With the Meta Data Service, an object maintains its original object type.

Without the Meta Data Service of the present invention, the definition of the objects would be embedded in the application source code. Costly alterations to the  
25 original source code would be required, and the original source code may not be available to be altered. With the Meta Data Service of the present invention, the existing code receives newly created object attributes in the receipt of the meta definitions of the object. Capabilities for processing the newly created object attributes are available in all software or application components at all processing

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points that process the object.

If a customer merely requires the storage of the new attribute, the update to the object requires no additional configuration work for the customer. Object attributes are passed from a client through any number of servers to the database. If, however, the customer wishes to perform processing on the newly created attribute, the customer may build a dedicated server.

Within some limits imposed by various databases, the Meta Data Service is able to alter the definition of the data storage of a database to reflect a change in the meta definition of any objects that the Meta Data Service manages. This is the reverse of typical fourth-generation languages (4GL's) where the database schema may drive the definitions of some of the constructs in the language. The initial database schema is automatically created by a meta data manager from the definitions of the objects that it is managing.

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## BRIEF DESCRIPTION OF THE DRAWINGS

5 The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

10

**Figure 1** depicts a pictorial representation of a distributed data processing system in which the present invention may be implemented.

**Figure 2** is a block diagram depicting a data processing system, which may be implemented as a server in a distributed data processing system.

15 **Figure 3** is a block diagram illustrating a general data processing system in which the present invention may be implemented.

**Figure 4** is a block diagram depicting an example in which the Meta Data Service may be used to collect and store data in a database.

**Figure 5** is a flowchart depicting a method used by a client to accept user  
20 input to be stored as data values for the attributes of the object that will eventually be stored in a database.

**Figure 6** is a flowchart depicting a method used by a server to accept a stream of data values for object attributes that are eventually stored in a database.

**Figure 7** is a flowchart depicting a method used by a Persistent Object Service  
25 in accepting a stream of data values for object attributes that are eventually stored in a database.

**Figures 8 and 9** are examples of graphical user interface windows that are presented to a user so that a user may enter data values for the attributes of a data object.

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**Figure 10A** is an example of a meta definition for an object.

**Figure 10B** is an example of a data stream containing data values for an object's attributes.

**Figure 10C** is an example of a meta definition for an object with an extended  
5 attribute.

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## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures, **Figure 1** depicts a pictorial representation of  
5 a distributed data processing system in which the present invention may be implemented.

Distributed data processing system **100** is a network of computers in which the present invention may be implemented. Distributed data processing system **100** contains a network **102**, which is the medium used to provide communications links  
10 between various devices and computers connected together within distributed data processing system **100**. Network **102** may include permanent connections, such as wire or fiber optic cables, or temporary connections made through telephone connections.

In the depicted example, a server **104** is connected to network **102** along with storage unit **106**. In addition, clients **108**, **110**, and **112** also are connected to a network  
15 **102**. These clients **108**, **110**, and **112** may be, for example, personal computers or network computers. For purposes of this application, a network computer is any computer, coupled to a network, which receives a program or other application from another computer coupled to the network. In the depicted example, server **104** provides data, such as boot files, operating system images, and applications to clients **108-112**.  
20 Clients **108**, **110**, and **112** are clients to server **104**. Distributed data processing system **100** may include additional servers, clients, and other devices not shown. In the depicted example, distributed data processing system **100** is the Internet with network **102** representing a worldwide collection of networks and gateways that use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a  
25 backbone of high-speed data communication lines between major nodes or host computers, consisting of thousands of commercial, government, educational, and other computer systems that route data and messages. Of course, distributed data processing system **100** also may be implemented as a number of different types of networks, such as for example, an intranet, a local area network (LAN), or a wide area network (WAN).

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**Figure 1** is intended as an example, and not as an architectural limitation for the processes of the present invention.

Referring to **Figure 2**, a block diagram depicts a data processing system, which may be implemented as a server, such as server **104** in **Figure 1**, in accordance to the present invention. Data processing system **200** may be a symmetric multiprocessor (SMP) system including a plurality of processors **202** and **204** connected to system bus **206**. Alternatively, a single processor system may be employed. Also connected to system bus **206** is memory controller/cache **208**, which provides an interface to local memory **209**. I/O bus bridge **210** is connected to system bus **206** and provides an interface to I/O bus **212**. Memory controller/cache **208** and I/O bus bridge **210** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge **214** connected to I/O bus **212** provides an interface to PCI local bus **216**. A number of modems **218-220** may be connected to PCI bus **216**. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors. Communications links to network computers **108-112** in **Figure 1** may be provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards.

Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, server **200** allows connections to multiple network computers. A memory-mapped graphics adapter **230** and hard disk **232** may also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk drive and the like, also may be used in addition or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000 system, a product of International Business Machines Corporation



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in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

With reference now to **Figure 3**, a block diagram illustrates a data processing system in which the present invention may be implemented. Data processing system 5 **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus architectures such as Micro Channel and ISA may be used. Processor **302** and main memory **304** are connected to PCI local bus **306** through PCI bridge **308**. PCI bridge **308** also may include an integrated memory 10 controller and cache memory for processor **302**. Additional connections to PCI local bus **306** may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus interface **314** are connected to PCI local bus **306** by direct component connection. In contrast, audio adapter **316**, graphics adapter **318**, and 15 printer adapter **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314** provides a connection for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**. SCSI host bus adapter **312** provides a connection for hard disk drive **326**, tape drive **328**, and CD-ROM drive **330** in the depicted example. Typical PCI local bus implementations will support three 20 or four PCI expansion slots or add-in connectors. Data processing system **300** could be connected through graphics adapter **318** to a computer display (not shown) and through printer adapter **319** to a printer (not shown).

An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3**. 25 The operating system may be a commercially available operating system such as OS/2, which is available from International Business Machines Corporation. "OS/2" is a trademark of International Business Machines Corporation. An object oriented programming system such as Java™ may run in conjunction with the operating system and provides calls to the operating system from Java™ programs or applications

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executing on data processing system 300. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive 326, and may be loaded into main memory 304 for execution by processor 302. Those of  
5 ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention may be applied to a multiprocessor data  
10 processing system.

For example, data processing system 300, if optionally configured as a network computer, may not include SCSI host bus adapter 312, hard disk drive 326, tape drive 328, and CD-ROM 330, as noted by the box with the dotted line 332 in **Figure 3** denoting optional inclusion. In that case, the computer, to be properly  
15 called a client computer, must include some type of network communication interface, such as LAN adapter 310, modem 322, or the like. As another example, data processing system 300 may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system 300 comprises some type of network communication  
20 interface. As a further example, data processing system 300 may be a Personal Digital Assistant (PDA) device which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not  
25 meant to imply architectural limitations with respect to the present invention.

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With reference now to **Figure 4**, a block diagram depicts an example in which the Meta Data Service may be used to collect and store data in a database. In summary, client **410** may be one of clients **108**, **110**, and **112** connected to a network **102**, shown in **Figure 1**. Client **410** collects values for the attributes of an object from  
5 a user through a graphical user interface (GUI) and submits them to server **420** for processing. Server **420** may be similar to server **104**, shown in **Figure 1**. The attributes are eventually stored in a relational database management system (RDBMS) **433**. At each stage of object processing, Meta Data Service **440** is queried for meta definitions **442**, which may be stored to and retrieved from meta definition storage  
10 **446** by data stream **444**.

It should be noted that **Figure 4** describes an embodiment of the invention in which the Meta Data Service and the applications that use the Meta Data Service are distributed in a distributed data processing system. Meta Data Service **440** may be located on one server in network **102**; a user is entering data into client **410** elsewhere  
15 on network **102**; server **420** is not necessarily the same server that holds Meta Data Service **440** or POS **430**, which may be located elsewhere in network **102**. However, the application that is presenting the GUI to the user, Meta Data Service **440**, POS **430**, and RDBMS **433** could be located within a single stand-alone data processing system **300**. In that case, Meta Data Service **440**, POS **430**, and RDBMS **433** could be separate  
20 software components or applications that contain processing logic similar to what would be found in software components or applications distributed across network **102**.

**Figures 5-7** provide flowcharts and the accompanying discussion provide further detail for the processing and data-flow shown in **Figure 4**.

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With reference now to **Figure 5**, a flowchart depicts a method used by a client to accept user input to be stored as data values for the attributes of the object that will eventually be stored in RDBMS 433. The process begins (step 500) when client 410 reads a definition of a screen in which the user will enter values for the object 5 attributes (step 510). Screen or GUI definitions 412 may be stored in client 410, server 420, or even RDBMS 433. In other words, GUI definitions 412 may be stored in any location on distributed data processing system 100 such that client 410 may retrieve the definitions for presentation use. Alternatively, GUI definitions 412 may not be predefined, in which case a GUI is built on-the-fly, as further described below.

10 An application executing on client 410 determines that user input is required for further processing. Client 410 requests a meta definition of the current object, i.e., the definition of the attributes for the current object, from Meta Data Service 440 (step 520). Query for meta definition 416 is routed through network 102 to Meta Data Service 440. In response, Meta Data Service 440 provides meta definition 418 15 to client 410 (step 530). Client 410 matches object attributes provided in meta definition 418 to GUI fields (step 540) and presents the GUI to the user (step 550).

An example of a GUI is provided in **Figure 8** as Customer Dialog 800. The object attributes may be used as field labels 811-815 in Customer Dialog 800, wherein the fields are text entry fields 801-805 in which the user provides data values 20 for the object attributes. The matching process may be accomplished by a simple name matching basis or by using a more complicated identification mechanism. In some cases, it may not be desired to have a predefined screen definition for a variety of reasons, such as system administration costs for maintaining properly defined screen definitions. In many cases, it may be possible for client 410 to build a screen 25 definition from the object attributes in meta definition 418.

One of ordinary skill in the art would understand that client 410 need not be coded to assume the presence of any attribute in the meta definition of an object. However, since it is possible to verify an attribute's presence, attribute specific processing is not precluded.

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After the user has entered all the data (step 560), client 410 submits the object for processing by one or more servers by transferring the object across the network or to a server process in the form of a stream of attribute data values 414 (step 570). The client-based processing of the current object then ends (step 580).

5 With reference now to **Figure 6**, a flowchart depicts a method used by a server in accepting a stream of data values for object attributes that are eventually stored in RDBMS 433. The process begins (step 600) when server 420 receives data value stream 414 from client 410 (step 610). Server 420 requests a meta definition of the current object, i.e., the definition of the attributes for the current object, from Meta  
10 Data Service 440 (step 620). Query for meta definition 426 is routed through network 102 to Meta Data Service 440. In response, Meta Data Service 440 provides meta definition 428 to server 420 (step 630).

One of ordinary skill in the art would understand that server 420 need not be coded to assume the presence of any attribute in the meta definition of an object.  
15 However, since it is possible to verify an attribute's presence, attribute specific processing is not precluded.

Meta definition 428 allows server 420 to interpret the recently received data stream for the current object. Server 420 performs any necessary attribute processing, according to meta definition 428, that may be required at this stage of processing  
20 (step 640). For example, it may be advantageous to verify the correctness and appropriateness of the user input values at a central location, such as server 420, rather than at a decentralized location, such as client 410. When server 420 completes its processing, it may transfer the current object to a different server on network 102 that processes different attributes. Server 420 then transmits the object as data value  
25 stream 424 to Persistent Object Service (POS) 430 (step 650). The server-based processing of the current object then ends (step 660).

With reference now to **Figure 7**, a flowchart depicts a method used by a Persistent Object Service in accepting a stream of data values for object attributes that are eventually stored in RDBMS 433. The process begins (step 700) when POS 430

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receives data value stream **424** from server **420** (step **710**). POS **430** requests a meta definition of the current object, i.e., the definition of the attributes for the current object, from Meta Data Service **440** (step **720**). Query for meta definition **436** is routed through network **102** to Meta Data Service **440**. In response, Meta Data  
 5 Service **440** provides meta definition **438** to POS **430** (step **730**).

One of ordinary skill in the art would understand that POS **430** need not be coded to assume the presence of any attribute in the meta definition of an object. However, since it is possible to verify an attribute's presence, attribute specific processing is not precluded.

10 Meta definition **438** allows POS **430** to interpret the recently received data stream for the current object. POS **430** maps the data values for the object to relational tables according to meta definition **438** (step **740**). At other times, POS **430** may perform table management **432** to update relational tables in RDBMS **433** according to meta definition **438**. Server **430** then transmits the object as data **434** to  
 15 RDBMS **433** (step **750**). The POS-based processing of the current object then ends (step **760**).

As shown with respect to **Figures 4-7**, applications within distributed data processing system **100** are designed such that, at any stage of object processing, an application does not assume to understand the definition or structure of an object, nor  
 20 is an application hard-coded with the object definitions. At each stage, an application queries the Meta Data Service for the meta definition of the object before proceeding with the processing of an object.

Structuring applications in conjunction with the Meta Data Service in this manner can be advantageous. For example, a corporation might create a set of  
 25 applications that use some group of objects to perform corporate tasks and has a group of servers that perform those tasks with those objects. However, those applications could be sold to a customer that finds the objects defined in the applications to be inadequate for its own needs.

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Thus, with the present invention, the customer may alter the definitions of one or more of the objects within the Meta Data Service to add the attributes which the customer wishes to process. Since all software or application components query a single location, the Meta Data Service, for the definitions of the objects at each  
5 processing point that requires knowledge of an object, the object definitions need to be altered in only a single location, the meta definitions within the Meta Data Service, and do not need to be altered in several different software components.

One of ordinary skill in the art will understand that the advantage of the Meta Data Service could not be accomplished using the subclassing feature of an object-  
10 oriented language. In other words, adding an attribute to an object's meta definition is not equivalent to subclassing an object. When an object is extended by subclassing, the object adopts a new object type. With the Meta Data Service, an object maintains its original object type.

Without the Meta Data Service of the present invention, the definition of the  
15 objects would be embedded in the application source code. Costly alterations to the original source code would be required, and the original source code may not be available to be altered. With the Meta Data Service of the present invention, the existing code receives newly created object attributes in the receipt of the meta definitions of the object. Capabilities for processing the newly created object  
20 attributes are simultaneously available in all software components or application components at all processing points that process the object.

If a customer merely requires the storage of the new attribute, the update to the object requires no additional work for the customer. Object attributes are passed from a client through any number of servers to the database. If, however, the  
25 customer wishes to perform processing on the newly created attribute, the customer may build a dedicated server.

**Figures 8-9** provide an example of a specific application of the Meta Data Service.

With reference again to **Figures 4 and 8**, a dialog window provides an

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example of a GUI for presenting an object's attributes to a user. A programmer may create this GUI definition **412** and present it as Customer Dialog **800** in order to obtain an address for a corporate customer. To do this, the programmer may create an "Address" object with meta definition **442** shown in **Figure 10A**.

5       The definition of the attributes may have additional information that is not shown, such as data type (e.g., ASCII or integer) or display information, such as fonts or colors.

Customer Dialog **800** may have a data entry field for each attribute in the object, and the data entry field may have a name that matches the name of the  
10 attribute. For example, data entry field **802** is labeled "Street" by label **812** that matches the "Street" attribute or attribute #3 of the meta definition of "Address" in **Figure 10A**.

Once the data is gathered by client **410**, it creates a data stream **414** to send the data to server **420**. In this example, the stream might resemble the data stream shown  
15 in **Figure 10B**.

The first item on the stream identifies the meta definition used to build the stream. In this example, the stream is simple an ordered list of the attribute values. If an attribute did not have a value, a place-holder could be put in the stream. More complicated stream formats could be defined that pass data more efficiently, such as  
20 passing only those values that have been modified.

When server **420** receives stream **414**, it creates a container to hold the stream. Server **420** uses the meta ID from the stream to get the number and meaning of the attributes on the stream by querying Meta Data Service **440** for meta definition **428** of the object or objects in the stream. The meta ID may be a simple integer, as shown,  
25 or the meta ID may be a text string which is used as a part of a query by Meta Data Service **440** to a database acting as storage for meta definitions **446**.

Server **420** could request the value of attributes of the object from the container. If the attributes were requested by name, the container could validate that specific attributes were present. Server **420** could also request the attributes by



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attribute ID, which would allow server **420** to validate the object's attributes against the object's meta definition **428** before processing a group of similar objects.

When server **420** has completed the processing for the object, server **420** passes the object to Persistent Object Storage **430** for storage in relational database management system **433**. POS maps the object attributes onto tables and columns in the database. For this example, there may be a table named "Address", which has one column for each attribute. The column name matches the attribute name. It is important to note that the RDBMS schema would be driven by the meta definition not the reverse.

10 Now assume that the programmer who wrote the original application sells it to a corporation that has international operations. The corporation determines that it must also have a country name in its address information. To accomplish this, it may change the meta definition of "Address" to resemble modified meta definition **442** shown in **Figure 10C** by adding an attribute, attribute #7 named "Country". Note  
15 that the classification of attributes is optional and that the use of "base attributes" and "extend attributes" may merely simplify the validation of the attributes that are received in a given meta definition.

The definition of the GUI screen must also be edited to add a data entry field "Country". An example of a modified GUI is provided in **Figure 9** as Customer  
20 Dialog **900** that has been modified from Customer Dialog **800** to include additional data entry field **906**. The object attributes in the meta definition for "Address" may be used as field labels **911-916** in Customer Dialog **900**, wherein the fields are text entry fields **901-906** in which the user provides data values for the object attributes. Customer Dialog **900** contains data entry field **906** labeled "Country" by label **916**  
25 that matches the "Country" attribute or attribute #7 of the meta definition of "Address".

When the meta definition for the "Address" object is extended, Meta Data Service **440** may contact POS **430** to request that it add a column "Country" to the table named "Address" to accommodate the new attribute.

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The modification of RDBMS 433 and GUI definition 412 may be performed through a system administration utility in Meta Data Service 440 or is performed semi-automatically by Meta Data Service 440 during creating of the new object attribute.

5 Client 410 will find new "Country" data entry field 906 in GUI definition 412 and will also find that the "Address" object, as defined by meta definition 418 has a "Country" attribute in which to store its value. Server 420 and POS 430 will also get the newly defined "Country" attribute for the "Address" object from meta definition 428 and meta definition 438. Each processing point in all software components or  
10 application components is aware of the newly created "Country" attribute and handles it correctly. It would also be possible for the system to incorporate a new server to process the "Country" attribute.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the  
15 art will appreciate that the processes of the present invention are capable of being distributed in a form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media such a floppy disc, a hard  
20 disk drive, a RAM, and CD-ROMs and transmission-type media such as digital and analog communications links.

The description of the present invention has been presented for purposes of illustration and description, but is not limited to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent  
25 to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

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# **CLAIMS:**

What is claimed is:

- 1 1. A method in a software component for processing a data object in a data  
2 processing system, said method comprising the computer-implemented steps of:  
3 sending a query for a meta definition of a data object; and  
4 processing the data object according to attributes in the meta definition for the  
5 data object.
- 1 2. The method according to claim 1 further comprising, before querying for a  
2 meta definition of a data object, determining an object type of a data object.
- 1 3. The method according to claim 1 further comprising receiving the meta  
2 definition for the data object prior to the step of processing the data object.
- 1 4. The method according to claim 1 wherein the software component is in a  
2 client.
- 1 5. The method according to claim 1 wherein the query for the meta definition for  
2 the data object is sent to a Meta Data Service.
- 1 6. The method according to claim 1 wherein the meta definition is cached to  
2 improve the performance of the Meta Data Service.
- 1 7. A method in a software component for processing a data object in a data  
2 processing system, said method comprising the computer-implemented steps of:  
3 receiving a query for a meta definition of a data object; and  
4 sending a meta definition of a data object in response to the query for the meta  
5 definition.

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1 8. A method according to claim 7 further comprising storing at least one meta  
2 definition of a data object.

1 9. A method according to claim 7 further comprising at least one object attribute  
2 in the meta definition of the data object.

1 10. The method according to claim 7 wherein the software component is a Meta  
2 Data Service.

1 11. The method according to claim 10 wherein the meta definition for the data  
2 object is sent to a software component residing in a client.

1 12. The method according to claim 7 wherein the meta definition is cached to  
2 improve the performance of the Meta Data Service.

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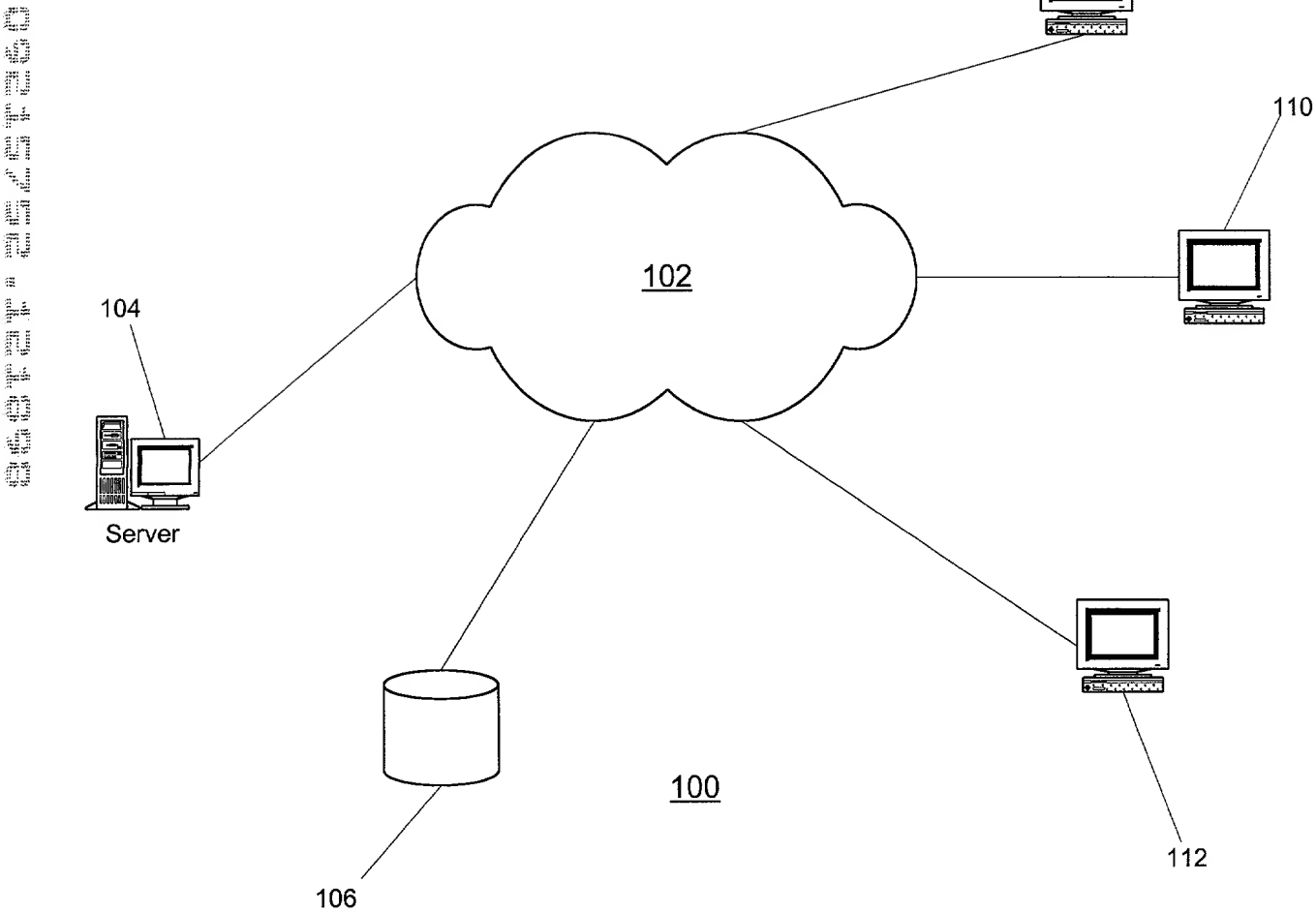
## **ABSTRACT OF THE DISCLOSURE**

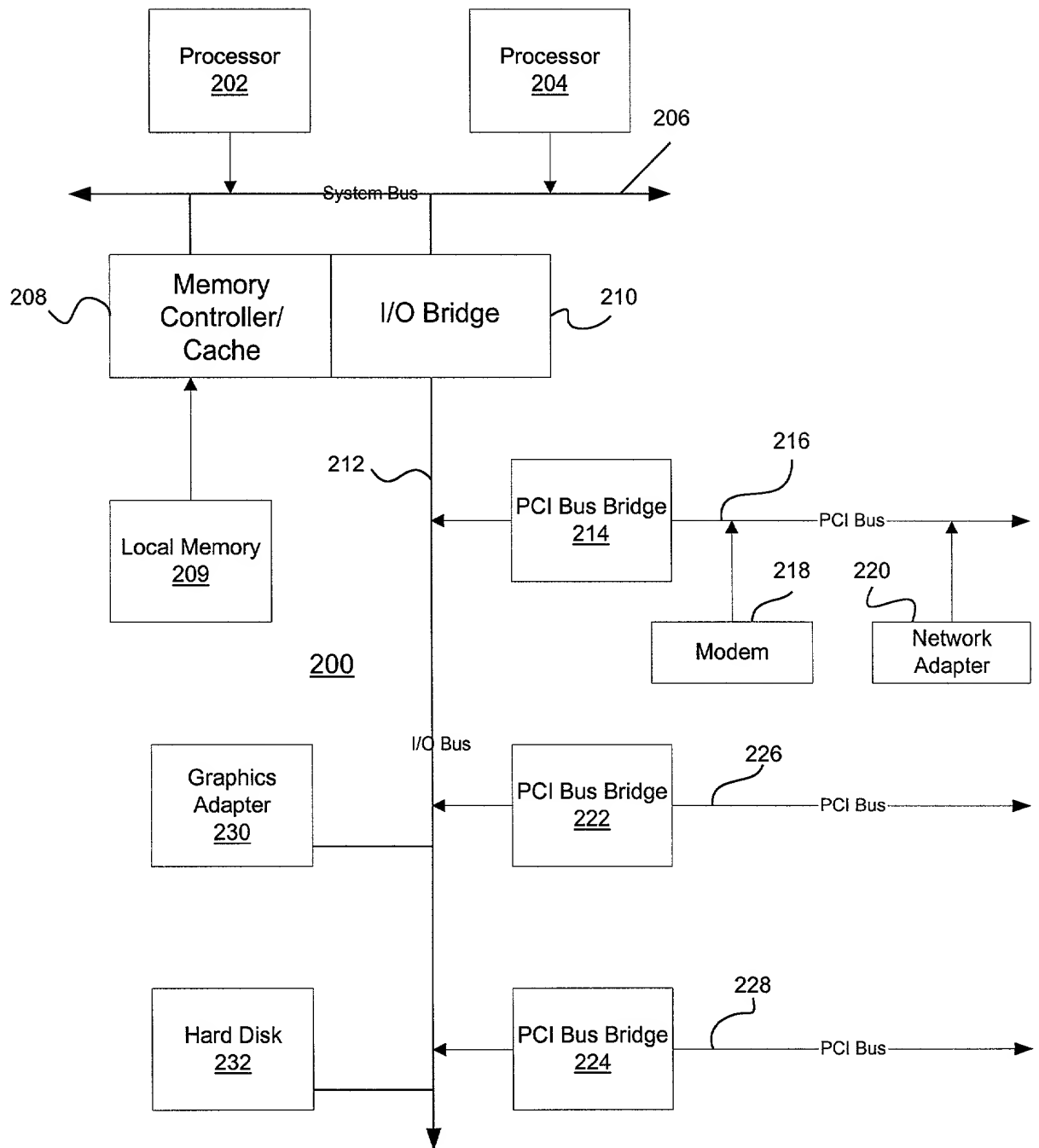
### **METHOD AND APPARATUS FOR A META DATA SERVICE IN A DATA PROCESSING SYSTEM**

As a solution to the problem of distributed knowledge of data object definitions, data object definitions are removed from the source code. A Meta Data Service is created and made available on a network which knows the definitions of all of the objects that are used by applications that are designed to use the Meta Data Service. When an object is created, the Meta Data Service creates and stores a meta definition for the object. Data objects are passed over a network in a "soft" format. Applications within a distributed data processing system are designed in such a manner such that, at any stage of object processing, an application does not assume to understand the definition or structure of an object, nor is an application hard-coded with the object definitions. At each stage, an application queries the Meta Data Service for the meta definition of the object before proceeding with the processing of an object. The application then receives a meta definition for the data object that allows the application to perform properly tailored processing for the data object.

Figure 1

Network





server

Figure 2

FIG. 3 is a block diagram of a client system 300 in accordance with the present invention. The client system 300 includes a processor 302, a host/PCI cache/bridge 308, main memory 304, and a bus 306. The processor 302 is connected to the host/PCI cache/bridge 308. The host/PCI cache/bridge 308 is connected to the main memory 304. The bus 306 is connected to the processor 302, the host/PCI cache/bridge 308, and the main memory 304. The bus 306 is also connected to a LAN adapter 310, an expansion bus interface 314, a graphics adapter 318, an audio/video adapter 319, an audio adapter 316, a SCSI host bus adapter 312, a keyboard and mouse adapter 320, a modem 322, and memory 324. The SCSI host bus adapter 312 is connected to a disk 326, a tape 328, and a CD-ROM 330. The expansion bus interface 314 is connected to the graphics adapter 318 and the audio/video adapter 319. The LAN adapter 310 is connected to the bus 306. The graphics adapter 318 is connected to the bus 306. The audio/video adapter 319 is connected to the bus 306. The audio adapter 316 is connected to the bus 306. The keyboard and mouse adapter 320 is connected to the bus 306. The modem 322 is connected to the bus 306. The memory 324 is connected to the bus 306. The disk 326, tape 328, and CD-ROM 330 are connected to the SCSI host bus adapter 312. The client system 300 is labeled 300.

Client

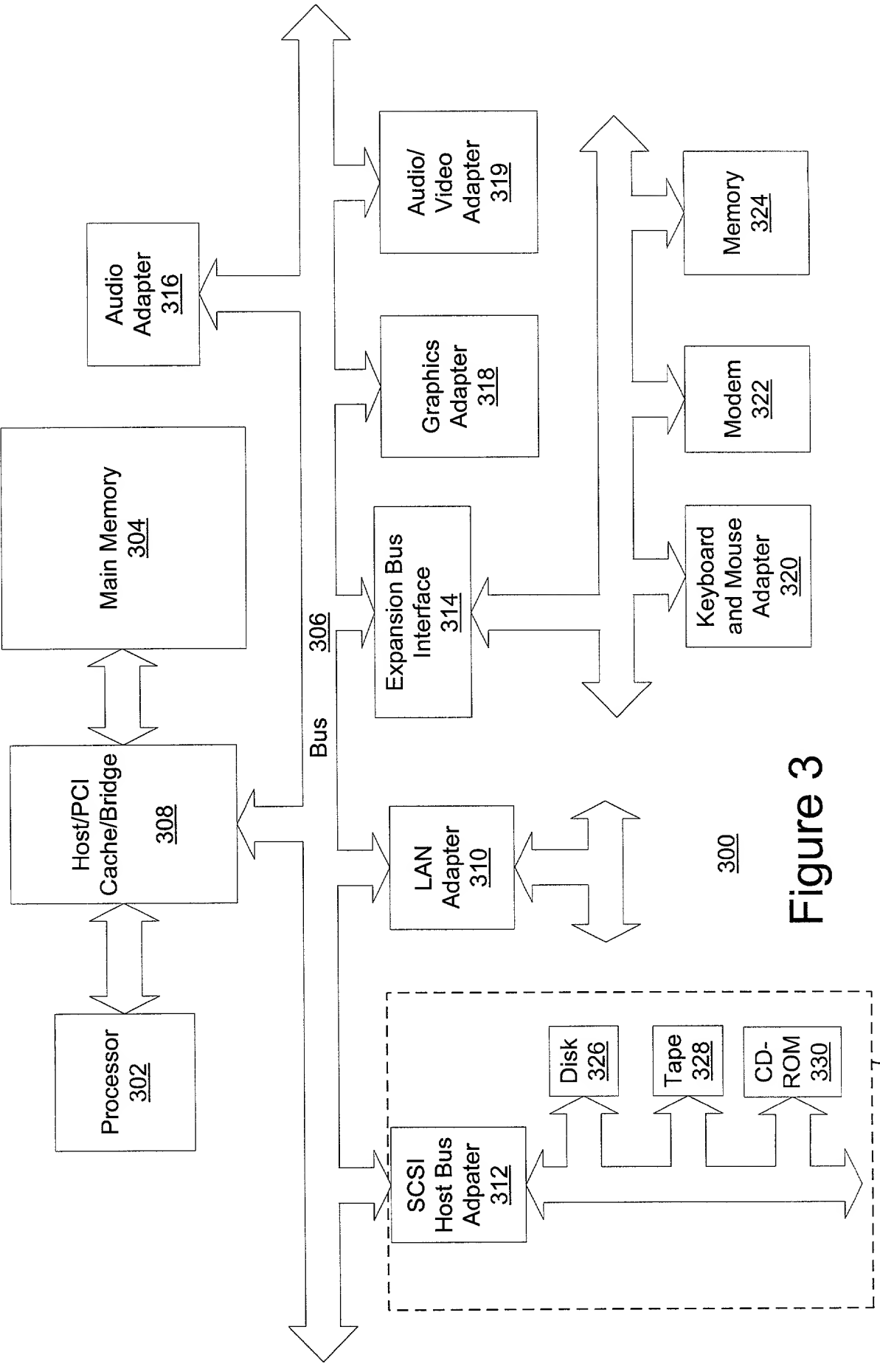
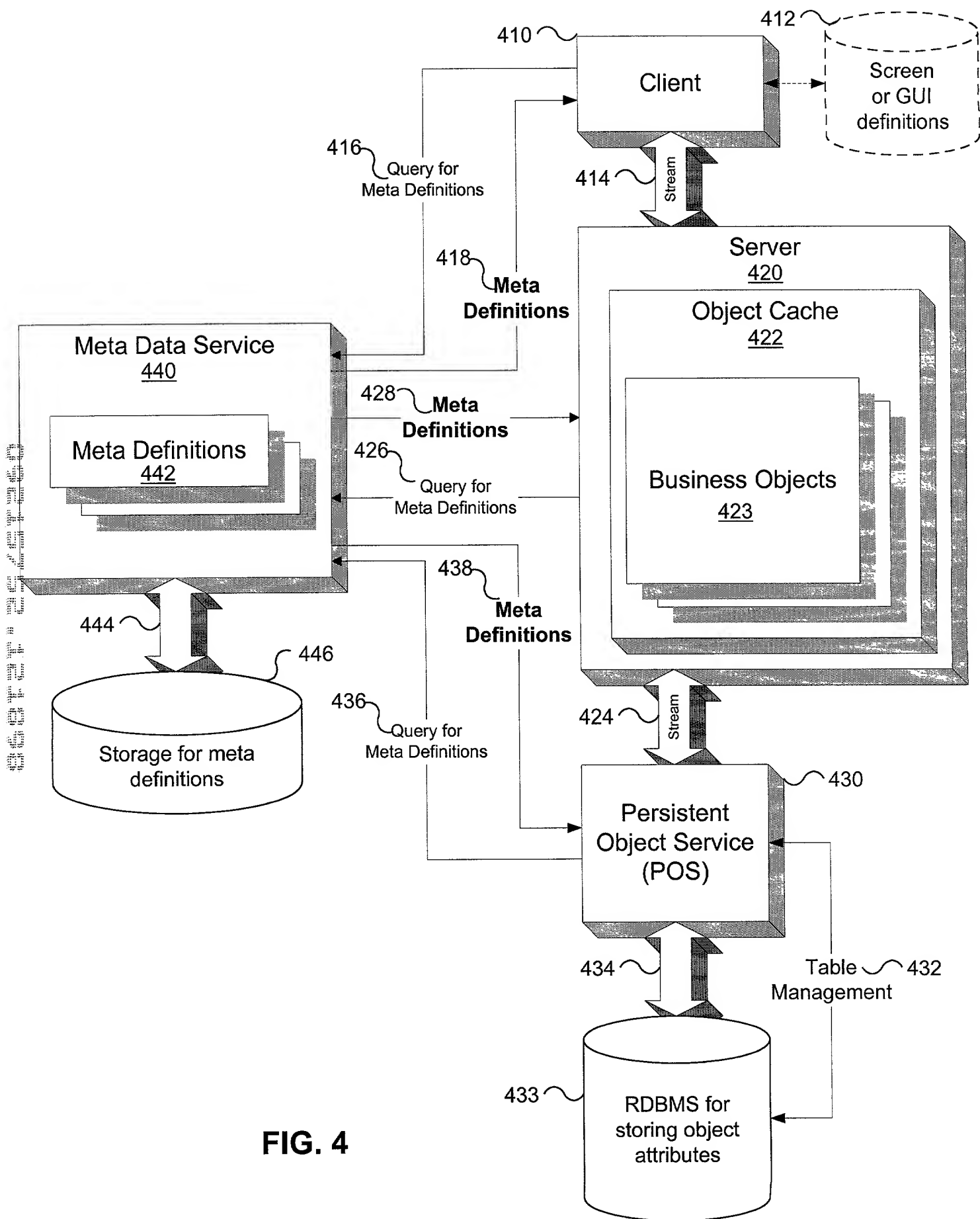


Figure 3

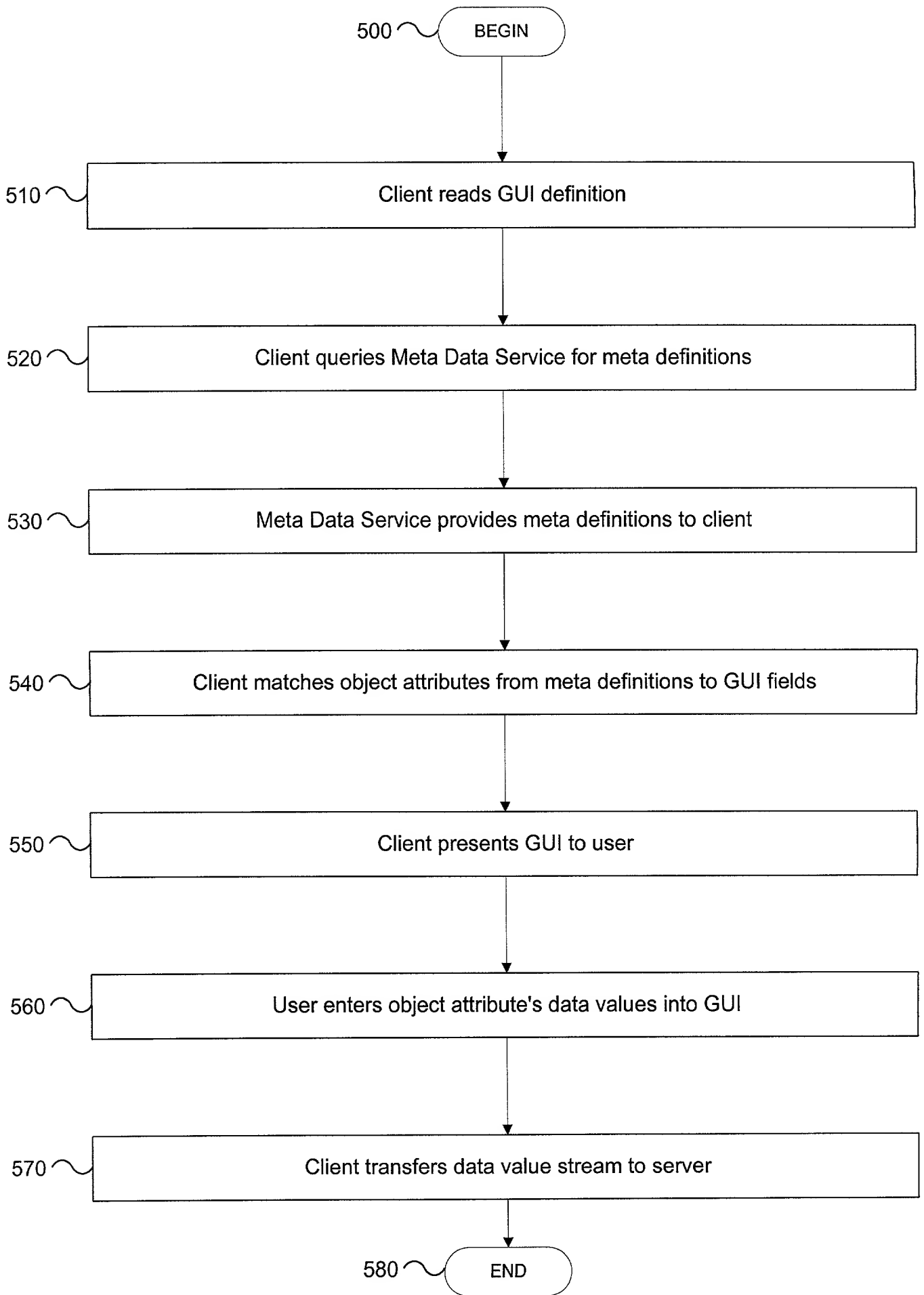
332





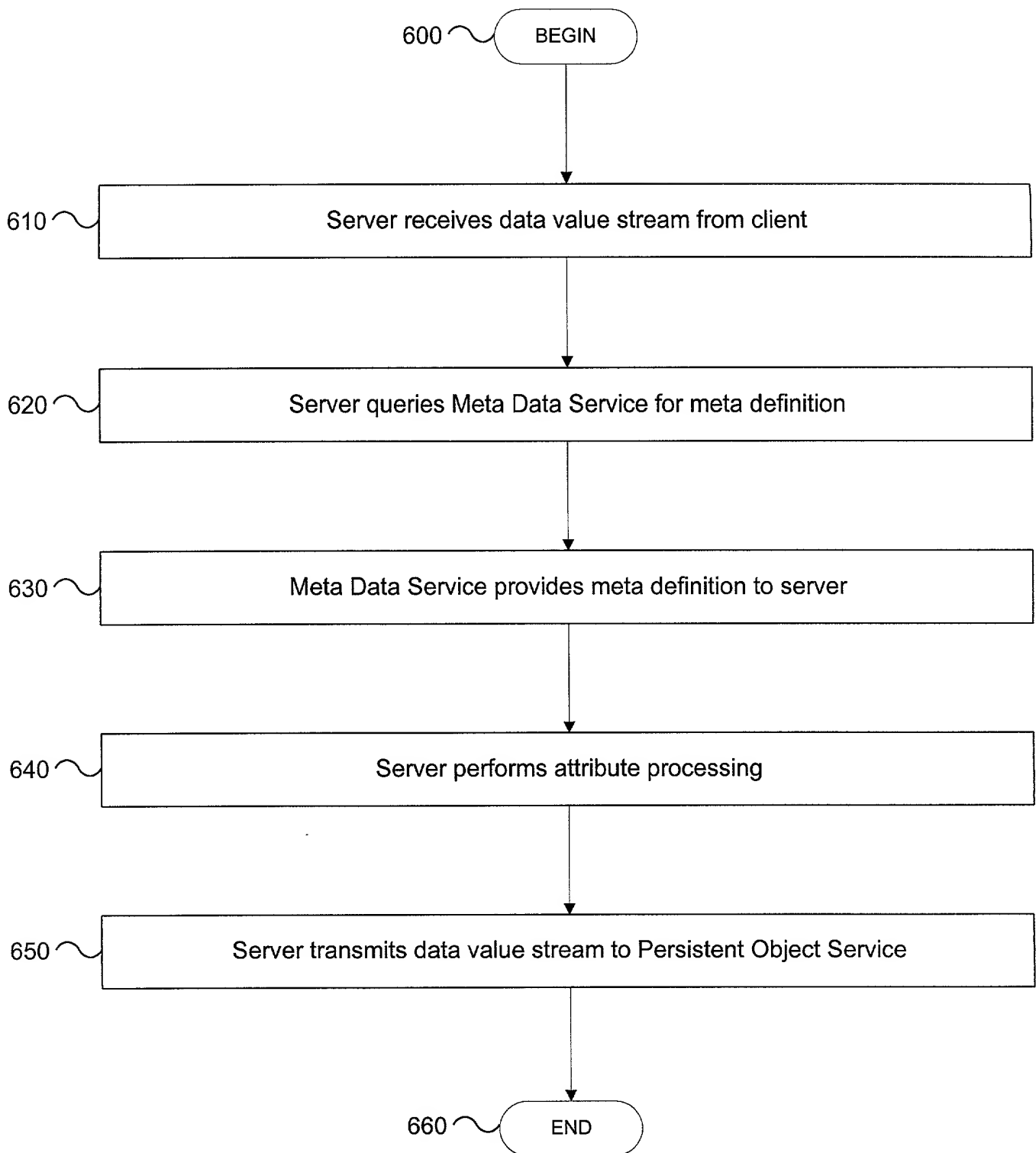
**FIG. 4**

FIG. 5 is a flowchart illustrating a process for GUI generation and data transfer.

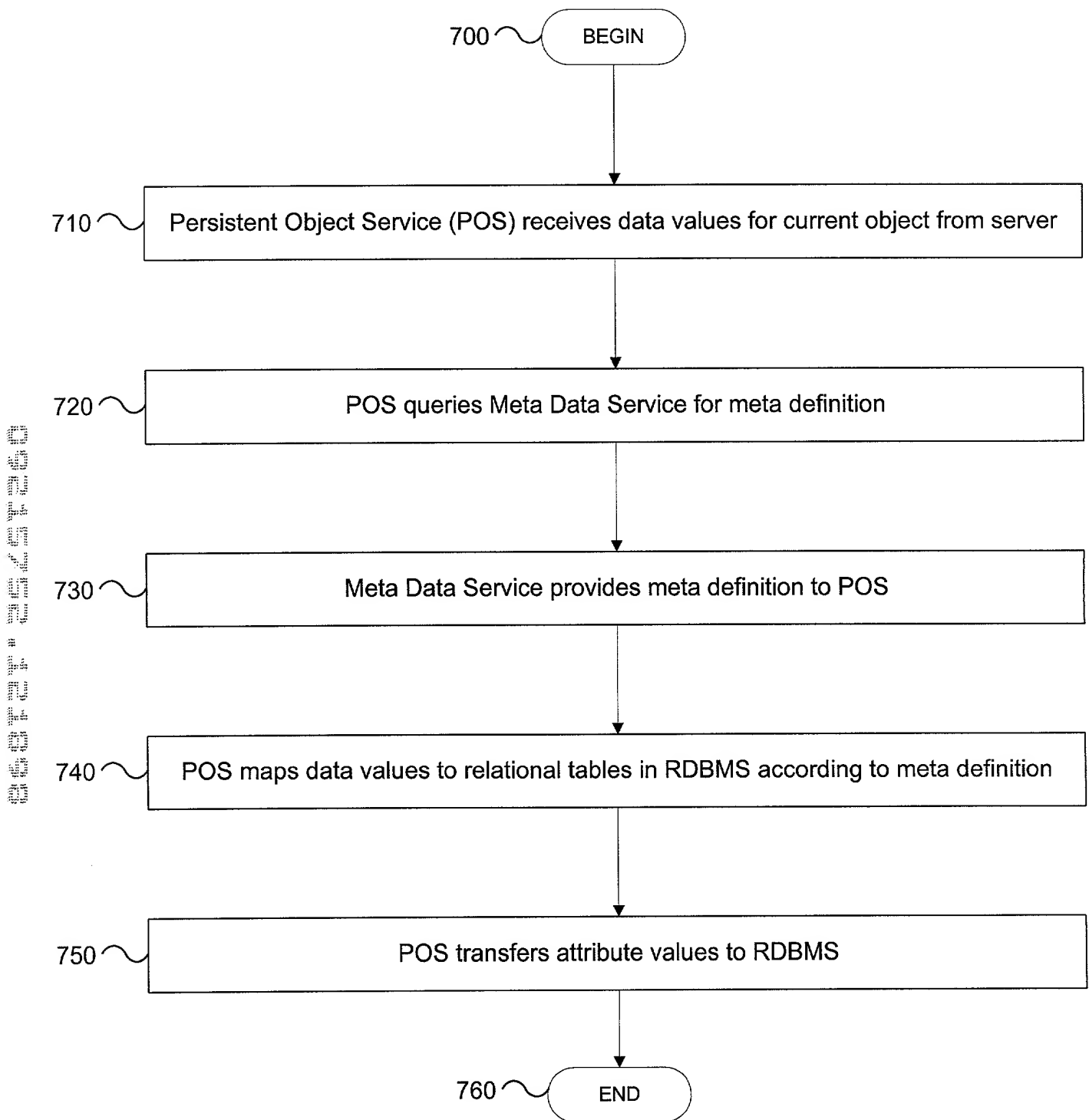


**FIG. 5**

600 610 620 630 640 650 660



**FIG. 6**



**FIG. 7**

800 ~ Customer Dialog

Customer Account Address Products Services

811 ~ Name 801

812 ~ Street 802

813 ~ City 803

814 ~ State 804

815 ~ ZIP 805

OK

Cancel

FIG. 8

900 ~ Customer Dialog

Customer	Account	Address	Products	Services
911 ~ Name		901		
912 ~ Street		902		
913 ~ City		903		
914 ~ State		904		
915 ~ ZIP		905		
916 ~ Country		906		

OK

Cancel

FIG. 9

Meta definition

Name:	Address
ID:	1
# of base attributes:	6
# of extended attributes:	0
Attribute list	
1	Customer ID
2	Name
3	Street
4	City
5	State
6	Zip

**FIG. 10A**

Data stream for object

1  
1  
John Doe  
101 Main Street  
Anytown  
IN  
99999

**FIG. 10B**

Meta definition

Name:	Address
ID:	1
# of base attributes:	6
# of extended attributes:	1
Attribute list	
1	Customer ID
2	Name
3	Street
4	City
5	State
6	Zip
7	Country

**FIG. 10C**

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DECLARATION AND POWER OF ATTORNEY FOR  
PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR A META DATA SERVICE IN A DATA PROCESSING SYSTEM

the specification of which (check one)

X is attached hereto.

\_\_\_ was filed on \_\_\_\_\_  
as Application Serial No. \_\_\_\_\_  
and was amended on \_\_\_\_\_  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, '1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, '119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

Priority Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year)	___ Yes ___ No
-------------------	--------------------	---------------------------	----------------

I hereby claim the benefit under Title 35, United States Code, '120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States



DOCKET NUMBER: AT9-98-464

application in the manner provided by the first paragraph of Title 35, United States Code, '112, I acknowledge the duty to disclose information material to the patentability of this application as defined in Title 37, Code of Federal Regulations, '1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial #)(Filing Date)(Status)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

John W. Henderson, Jr., Reg. No. 26,907; Thomas E. Tyson, Reg. No. 28,543; James H. Barkadale, Jr., Reg. No. 24,091; Casimer K. Salys, Reg. No. 28,900; Robert M. Carwell, Reg. No. 28,499; Douglas H. Lefevre, Reg. No. 26,193; Jeffrey S. LaBaw, Reg. No. 31,633; David A. Mims, Jr., Reg. 32,708; Volel Emile, Reg. No. 39,969; Richard A. Henkler, Reg. No. 39,220; and Anthony V. England, Reg. No. 35,129; Leslie A. Van Leeuwen, Reg. No. 42,196; Christopher A. Hughes, Reg. No. 26,914; Edward A. Pennington, Reg. No. 32,588; John E. Hoel, Reg. No. 26,279; Joseph C. Redmond, Jr., Reg. No. 18,753; Marilyn S. Dawkins, Reg. No. 31,140; Duke W. Yee, Reg. No. 34,285; David W. Carstens, Reg. No. 34, 134; and Colin P. Cahoon, Reg. No. 38,836; Joseph R. Burwell, Reg. No. P-43,866.

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DOCKET NUMBER: AT9-98-464DECLARATION AND POWER OF ATTORNEY FOR  
PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR A META DATA SERVICE IN A DATA PROCESSING SYSTEM

the specification of which (check one)

X is attached hereto.       was filed on \_\_\_\_\_  
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Prior Foreign Application(s):

Priority Claimed

_____	_____	_____	Yes	No
(Number)	(Country)	(Day/Month/Year)		

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---

(Application Serial #)

(Filing Date)

(Status)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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